SMOKYBROWN COCKROACHES, *PERIPLANETA FULIGINOSA* (DICTYOPTERA: BLATTIDAE), DISPLACED FROM THEIR HARBORAGES BY RED IMPORTED FIRE ANTS, *SOLENOPSIS INVICTA* (HYMENOPTERA: FORMICIDAE)[1]

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ABSTRACT: Field observations and experiments revealed that smokybrown cockroaches, *Periplaneta fuliginosa*, may be driven from their secluded daytime harborages into direct sunlight by foraging imported red fire ants, *Solenopsis invicta*. Ant activity elicited agonistic behaviors from the cockroaches, but the ants were not repelled.

Cockroaches generally are thought to confine their daily activity to the scotophase of the photoperiod. During the summer in Houston, Texas, the smokybrown cockroach, *Periplaneta fuliginosa* (Serville), is active from 4-5 h after sunset until about 1 h before sunrise, with maximum activity near 0000 h (Appel and Rust, 1986). Cockroaches were not observed abroad during daylight. Laboratory studies with *P. fuliginosa* also indicate limited photophase activity and negative phototaxis (Appel, unpublished). It was, therefore, surprising to find both adult and nymphal stages of *P. fuliginosa* abroad in direct sunlight on a north facing stone wall at 1500 h CDT in Auburn, Alabama. The cockroaches (n=15) were motionless except for occasional jerking (rapid vibrations of the body in the saggital plane) and stilting (elevating the body high off the substrate by full extension of the legs). Both of these behaviors are considered moderately intensive agonistic acts (Gorton et al., 1983).

Examination of the wall revealed foraging red imported fire ants, *Solenopsis invicta* Buren. Agonistic acts were elicited from the cockroaches by any physical contact with the ants, particularly from ant bites. Although nymphal *P. fuliginosa* exude a sticky, reportedly defensive, secretion from their tergal glands (Ichinosé and Zennyoji, 1980), the predatory *S. invicta* were not repelled. Cockroach harborage sites within the wall had 10-15 ants per cm^2 that were removing cockroach feces. The ants had driven the cockroaches out of their harborage sites and into the sunlight. Instead of seeking new harborages, the cockroaches remained exposed on the wall. The cockroaches were collected by hand and brought to the laboratory and held at ca. 24°C and 45% RH; there was no mortality after 5 days.

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To further investigate the displacement of cockroaches from their harborages, ten 0.95-1 glass jars, each containing a 7 by 4 cm-diam cylindrical cardboard harborage, and 10 cockroaches were positioned 0.5-2.0 m from outdoor fire ant mounds at 0800 h CDT. The inside upper surface of each jar was coated with a thin 5 to 6 cm wide band of petroleum jelly to prevent escape of the cockroaches but allow free access to the ants. Each harborage was contaminated with a two-week accumulation of feces from 50 cockroaches. Within 1 hr after the jars had been positioned, ant foragers had found and invaded the jars. The ants readily entered the cockroach harborages and foraged upon the feces. Ant densities of as low as 1-3 ants per cm^2 elicited agonistic acts from the cockroaches and drove the cockroaches out of their harborages into the light.

Ant predation has been shown to cause significant reductions in prey populations including ticks, scale insects, cat fleas, houseflies, rootworm eggs, boll weevils, and at least 32 other arthropod species (see references in Silverman and Appel, 1984). Predation by the native fire ant, *S. geminata* (Fab.), in corn and squash fields in Mexico reduced the number of blattid cockroaches per 10 plants from 1.83 ± 1.47 ($\bar{x} \pm SE$) to 0 (Risch and Carroll, 1982).

Cockroach-ant interactions have not been thoroughly investigated. The unusual occurrence of daytime exposed cockroaches indicates the severity of ant annoyance and perhaps the importance of ants in cockroach field ecology. Finally, the lack of movement of exposed cockroaches toward new harborage sites is problematic and under further investigation.

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LITERATURE CITED

Appel, A.G. and M.K. Rust. 1986. Time-activity budgets and spatial distribution patterns of the smokybrown cockroach, *Periplaneta fuliginosa* (Dictyoptera: Blattidae). Ann. Entomol. Soc. Am. 79: 104-106.

Gorton, R.E., Jr., K.G. Colliander and W. J. Bell. 1983. Social behavior as a function of context in a cockroach. Anim. Behav. 31: 152-159.

Ichinosé, T. and K. Zennyoji. 1980. Defensive behavior of the cockroaches, *Periplaneta fuliginosa* Serville and *P. japonica* Karny (Orthoptera: Blattidae) in relation to their viscous secretion. App. Ent. Zool. 15: 400-408.

Risch, S.J. and C.R. Carroll. 1982. Effect of a keystone predaceous ant, *Solenopsis geminata*, on arthropods in a tropical agroecosystem. Ecology 63: 1979-1983.

Silverman, J. and A.G. Appel. 1984. The pupal cocoon of the cat flea *Ctenocephalides felis* (Bouché) (Siphonaptera: Pulicidae): a barrier to ant predation. Proc. Entomol. Soc. Wash. 86: 660-663.